This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1.(currently amended) A method for the microstructuring of an optical waveguide to produce an optical functional element according to claim 20, comprising the steps of:

providing an optical waveguide comprising a first cross-sectional region having a first refractive index, a second cross-sectional area having a second refractive index, and a boundary region in the transition from the first to the second cross-sectional area,

exposing the optical waveguide to laser radiation in the form of at least an ultra-short single pulse or a sequence of pulses with a defined energy input; and

modifying at least one optical property of the optical waveguide at one defined portion at least of the boundary region as a result of the step of exposing the optical waveguide to laser radiation.

2. (original) The method according to claim 1, in which the modification is a change in the refractive index of the material of the first or of the second cross-sectional region or both.

3. (original) The method according to claim 1, in which the modification is the creation of a scattering center by microdamage or by the removal of material.

4. (original) The method according to claim 1, in which the modification is a transformation of the phase of the material of the first or of the second cross-sectional region.

5. (original) The method according to claim 1, in which the laser radiation is chosen in such a manner that at the defined portion of the boundary region a charge carrier plasma with a charge carrier density dependent on the desired modification is produced.

6. (original) The method according to claim 5, in which the laser radiation comprises a power density of roughly 10^{10} W/cm^2 or of more than 10^{10} W/cm^2.

7. (original) The method according to claim 6, in which the laser radiation comprises single pulses having a duration of roughly 10^{-10} seconds or of between 0.1 ps and 50 ps and an energy of roughly 10 nanojoules (nj) or less than 10 nanojoules (nj).

8. (original) The method according to claim 6, in which the wavelength of the laser radiation is chosen so that the optical waveguide is transparent in the light path up to the defined portion of

the boundary region for light of the chosen wavelength up to a power density of roughly 10^{10} W/cm^2.

9. (original) The method according to claim 1, in which a laser beam is focused onto the defined portion of the boundary region by means of a microscope lens.

10. (original) The method according to claim 1, in which a laser beam is irradiated so that it enters the optical waveguide at an angle of 90° to an outer face of said optical waveguide at the point of impact.

11. (original) The method according to claim 1, in which a laser beam is guided through an immersion fluid before it enters into the optical waveguide.

12. (original) The method according to claim 1, in which the modification is produced in such a manner that at the respective portion of the boundary region light can be coupled out of the waveguide or in such a manner that light can be coupled into the waveguide at the respective portion of the boundary region, or that light can be coupled in and also coupled out at the respective portion of the boundary region.

13. (original) The method according to claim 1, in which the modification is produced on a plurality of defined portions of the boundary region in such a manner that from the modified boundary region portions a radial radiation of defined, uniform light intensity takes place when light is coupled into the optical waveguide at one longitudinal end.

14. (original) The method according to claim 1, in which the modification is produced at a plurality of defined portions of the boundary region in the longitudinal direction of the optical waveguide or in a direction perpendicular thereto or in both mentioned directions of the optical waveguide in such a manner that an optical grating, a spiral, a cross, a photonic bandgap structure, a combination of lines and dots, or a combination of the above-mentioned structures is produced.

15. (original) The method according to claim 1, in which the optical waveguide is moved relative to the laser beam or the laser beam is moved relative to the optical waveguide.

16. (original) The method according to claim 1, in which the first cross-sectional portion is an optical waveguide core and the second cross-sectional portion is an optical waveguide cladding.

17. (original) The method according to claim 1, in which the optical waveguide comprises from the inside to the outside more than two cross-sectional portions having different refractive

indices and a corresponding number of boundary regions of adjacent cross-sectional portions, and in which modifications are disposed at more than one boundary region.

18. (original) The method according to claim 1, in which the optical waveguide comprises a continuous cross-sectional profile of the refractive index, and in which the modification takes place in at least one pre-selected cross-sectional portion.

19. (canceled)

20. An optical functional element comprising:

an optical waveguide comprising a first cross-sectional region with first refractive index, a second cross-sectional region with a second refractive index, and a boundary region in the transition from the first to the second cross-sectional region,

wherein at least one defined portion of the boundary region is provided with a modification of at least one optical property of the optical waveguide.

21. (original) The optical functional element according to claim 20, in which the modification is a change in the refractive index of the material of the first or second cross-sectional region or of both.

22. (original) The optical functional element according to claim 20, in which the modification is the creation of a scattering centre by micro-damage or by the removal of material.

23. (original) The optical functional element according to claim 20, in which the modification is a transformation of the phase of the material of the first or of the second cross-sectional region or of both.

24. (original) The optical functional element according to claim 20, in which the modification is constructed in such a manner that at the respective portion of the boundary region light is coupled out of the waveguide, or in such a manner that light at the respective portion of the boundary portion can be coupled into the waveguide, or in such a manner that light can be coupled in and also coupled out at the respective portion of the boundary region.

25. (original) The optical functional element according to claim 20, in which the modification is provided at a plurality of defined portions of the boundary region in such a manner that from the modified boundary region portions a radial radiation of defined, uniform light intensity takes place if light is coupled into the optical waveguide at a longitudinal end.

26. (original) The optical function element according to claim 20, in which the modification is disposed at a plurality of defined portions of the boundary region in the longitudinal direction of the optical waveguide or in a direction perpendicular thereto or both mentioned directions of the optical waveguide in such a manner that an optical grating, a spiral, a cross, a photonic bandgap structure, a combination of lines and dots, or a combination of the above-mentioned structures is produced.

27.(currently modified) A device for microstructuring an optical waveguide with laser radiation to produce an optical function element according to claim 20, the device comprising:

a laser constructed to emit at least one light pulse, and

a focusing device,

wherein the laser radiation has a power density of roughly 10^{10} W/cm^2 or more.

28.(original) The device according to claim 27, in which the laser is constructed to emit light pulses with a maximum duration of roughly 10^{-10} seconds or of between 0.1 and 50 ps.

29. (original) The device according to claim 28, in which the laser is constructed to emit light pulses having an energy of roughly 10 nanojoules (nj) or less than 10 nanojoules (nj).

30. (original) The device according to claim 27, in which the frequency of the laser radiation is chosen to correspond to the material of the optical waveguide on the light path penetrated by radiation in the optical waveguide, so that laser radiation with a power density of roughly 10^{10} W/cm^2 or of more than 10^{10} W/cm^2 can only enter the defined depth portion.

31. (original) The device according to claim 27, having a mounting for an optical waveguide, which is constructed to hold the optical waveguide so that it is displaceable in its longitudinal direction or can rotate around its longitudinal axis, or both.

32. (original) The device according to claim 27, in which the focusing device is a microscope lens.

33. (original) The device according to claim 27, in which the focusing device for performing one or more of the following movements is mounted: a displacement in the direction of the spacing of the optical waveguide or in the longitudinal direction of the optical waveguide, or a rotation around its longitudinal axis.

34. (original) The device according to claim 27, in which the optical waveguide and the focusing device are disposed in such a manner that a laser beam enters the optical waveguide at an angle of 90° to an outer face of said optical waveguide at the point of impact.